

US Wind Turbine Database Summary

Version: USWTDB V5.2

Release Date: October 12, 2022

I. ACRONYMS:

ACP	American Clean Power Association
DOF	Digital Obstacle File
FAA	Federal Aviation Administration
LBNL	Lawrence Berkeley National Laboratory
OE/AAA	Obstruction Evaluation / Airport Airspace Analysis
USGS	United States Geological Survey
EIA	Energy Information Administration
USWTDB	United States Wind Turbine Database

II. ABOUT THE DATABASE:

In 2016, USGS, LBNL, and ACP (formerly AWEA) began collaborating on development of the USWTDB. Their goal was to create a joint product that would be more comprehensive and accurate than their individual wind turbine data sets. Federal agencies began using these combined data in March 2017, and in April 2018 the data were released to the public. The database is maintained and updated quarterly to reflect new turbine additions, removals, and changes to the data.

These data are used by government agencies, scientists, private companies, and citizens for a variety of analyses. Examples include operational impact assessments of turbines on air defense radar, weather and general aviation, analyses related to the role of wind energy in the U.S. electric grid, interactions between wind energy facilities and wildlife, and investments in wind energy infrastructure.

The data were created by combining publicly-available data sets from the Federal Aviation Administration (FAA), USGS data from a prior effort, online sources, and data privately held by ACP and LBNL. The locations of all turbines are visually verified to within plus or minus 10 meters using high-resolution imagery. Technical specifications data of the turbines are collected from wind energy developers, equipment manufacturers, and from online sources.

III. DATA SOURCES:

Data were added, compiled, and updated in this edition of the USWTDB using the following sources:

- | | |
|--|------------------------------|
| • USGS Onshore Industrial Wind Turbine Locations for the United States | Release Date: March, 2014 |
| • LBNL Wind Turbine Database | Release Date: March, 2017 |
| • FAA Digital Obstacle File (DOF) | Release Date: August 9, 2022 |
| • FAA Obstruction Evaluation (OE/AAA) | Release Date: August 1, 2022 |
| • ACP Q2-2022 Wind Turbine Dataset | Release Date: August 3, 2022 |

- EIA Form 860 ER – Schedule 3 – Wind Data Release Date: June 2, 2022
- USGS Visual Verification (satellite imagery) Date: September, 2022

IV. VARIABLE CHANGES OR ADDITIONS:

No new variables were added this quarter.

V. VARIABLE NAMES AND DEFINITIONS:

Variable list and definitions can be found in the codebook that accompanies this release.

VI. SUMMARY OF DATASET AND CHANGES THIS QUARTER:

This edition of the USWTDB contains **72,357** turbines distributed across 43 U.S. States, Guam, and Puerto Rico.

Changes and updates to the database this quarter include the following:

- Addition of 345 turbine records. Additions include:
 - 345 new turbines.
- Removed 118 turbine records. Removals include:
 - 24 duplicate turbines removed.
 - 66 decommissioned turbines.
 - 28 reclassified as "not a turbine" (Either another structure mislabeled, or nothing in imagery >2 years after "built date").
- A total of 6,114 attribute changes were made. These include:
 - 198 "faa_asn" updates.
 - 1,113 "p_name" updates.
 - 632 "p_year" updates.
 - 1,561 "p_tnum" updates.
 - 3 "p_cap" updates.
 - 1 "t_cap" update.
 - 197 "t_rsa" updates.
 - 1 "t_ttlh" update.
 - 68 "t_conf_atr" updates.
 - 717 "t_conf_loc" updates.
 - 1,130 "t_img_date" updates.
 - 434 "t_img_srce" updates.
 - 27 "xlong" updates.
 - 32 "ylat" updates.

NUMBER OF WIND TURBINES BY STATE:

The USWTDB currently includes wind turbines from 43 U.S. states, plus Guam and Puerto Rico. Table 2 reports the number of turbines in each of these states and territories for the current release (Q2-2022) as well as the previous quarterly release (Q1-2022) for comparison. The changes by state reported in Table 2 may be due to turbines added to the dataset (via FAA and ACP data) and/or duplicate and decommissioned turbines removed from the dataset.

Table 2: Summary of Turbines by State

State	Q2-2022	Q3-2022	Change	State	Q2-2022	Q3-2022	Change
AK	143	143	0	NE	1,571	1,567	-4
AR	1	1	0	NH	84	84	0
AZ	269	271	2	NJ	6	6	0
CA	6,013	5,981	-32	NM	1,952	1,952	0
CO	2,899	2,878	-21	NV	68	68	0
CT	3	3	0	NY	1,198	1,217	19
DE	1	1	0	OH	504	500	-4
GU	1	1	0	OK	5,359	5,370	11
HI	132	132	0	OR	2,121	2,121	0
IA	6,203	6,205	2	PA	751	751	0
ID	541	541	0	PR	63	63	0
IL	3,543	3,550	7	RI	35	35	0
IN	1,615	1,615	0	SD	1,413	1,413	0
KS	3,961	3,962	1	TN	18	18	0
MA	92	92	0	TX	18,070	18,315	245
MD	80	80	0	UT	208	208	0
ME	412	412	0	VA	2	2	0
MI	1,633	1,633	0	VT	73	73	0
MN	2,688	2,689	1	WA	1,826	1,826	0
MO	1,174	1,174	0	WI	451	451	0
MT	803	803	0	WV	419	419	0
NC	105	105	0	WY	1,458	1,458	0
ND	2,168	2,168	0	TOTAL	72,130	72,357	227

VII. CONFIDENCE IN TURBINE LOCATIONS:

The level of confidence¹ in turbine latitude/longitude coordinates remains very high, thanks to the visual verification efforts from USGS. Currently, 69,379 (95.9%) turbine points have high location confidence, and only 3.8% of turbines have low location confidence. 100% of the turbine locations in this dataset have been visually examined using satellite imagery. Location confidence of points is summarized in Table 3.

Table 3: Level of confidence in turbine locations

Location Confidence	Q2-2022		Q3-2022	
	Freq.	Percent	Freq.	Percent
(3) High	68,648	95.2%	69,379	95.9%
(2) Partial	262	0.4%	197	0.3%
(1) Low/none	3,220	4.5%	2,781	3.8%
(0) Not checked	0	0.0%	0	0.0%

We are aware of the existence of turbines in the dataset that have a *high* location confidence but have been dismantled. These would be turbines that were previously verified but have since been decommissioned. If users are aware of any turbines that have been dismantled but remain in the dataset please send an email to uswtodb@lbl.gov with details about them, or use the “submit a suggested correction” button via the USWTDB online viewer. Note that the *case_id* for the turbine being corrected will automatically be included if you use the button via the viewer. If you submit a correction via email, please include *case_id*.

¹ **Location confidence** (conf_loc) is rated on a 0-3 scale:

- 0—Not visually verified (these points are in the queue for verification in the next quarter)
- 1—No turbine shown in image; image has clouds; imagery older than turbine built date
- 2—Partial confidence: image shows a developed pad with concrete base and/or turbine parts on the ground
- 3—Full confidence: image shows an installed turbine or a tower being constructed; at least partially installed

VIII. CONFIDENCE IN TURBINE ATTRIBUTES:

The level of confidence² in the attributes (such as total height, hub height, and rotor diameter) of each wind turbine remains high. We have high confidence in attributes for 86.5% of the turbines, partial confidence in 5.5% of turbines, and low or no confidence in 7.9%. Turbine points are categorized as “partial” confidence if the ACP attribute data conflicts substantially³ with existing records. Attribute confidence is summarized in Table 4.

Table 4: Level of confidence in turbine attributes

Attribute Confidence	Q2-2022		Q3-2022	
	Freq.	Percent	Freq.	Percent
(3) High	62,571	86.8%	62,615	86.5%
(2) Partial	4,109	5.7%	4,004	5.5%
(1) Low/none	5,450	7.6%	5,738	7.9%
(0) Not checked	0	0.0%	0	0.0%

The seven attributes that are collected are well populated across the dataset. Each attribute is populated in at least 92% of turbines, and over 92% of turbines in the USWTDB have data populated in *all seven* turbine attributes. Attribute data are summarized in Table 5.

Table 5: Number of turbines with data populated and summary statistics for seven turbine attributes

Turbine Attribute	# of Turbines	% of Turbines	Minimum	Median	Maximum
Project year	71,790	99.2%	1981	2012	2022
Total height (m)	67,785	93.7%	30.4	130.1	205.4
Hub height (m)	67,785	93.7%	19	80	137
Rotor diameter (m)	67,844	93.8%	13.4	100	162
Capacity (kW)	68,282	94.4%	50	2000	6000
Turbine Manufacturer	68,111	94.1%	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
Turbine Model	67,974	93.9%	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
<i>All Seven Attributes</i>	<i>67,634</i>	<i>93.5%</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>

² **Attribute confidence** (conf_attr) is rated on a 1-3 scale:

1—No confidence: no facility data, no name, nothing in publications

2—Partial confidence: incomplete information or substantial conflict between data sources

3—Full confidence: consistent information across multiple data sources

³ A “substantial” conflict was defined as any of the following differences (+/-): p_year 4 years; t_hh 10 meters; t_rd 10 meters; t_ttlh 50 feet; t_cap 250 kW. These tolerances will also be examined in the coming quarters and are expected to tighten over time.